

# 13 Areas and perimeters

Here you have a bird's eye view for the surface of the Norba Caesarina school. You can see different parts.

Could you write the different buildings that you see and the shape of their areas?



Other kind of structures are the paved zones like the small football pitch, the car park,...



Could you do the same with these areas? That is to write the name and the shape.

Next to the picture you have a ruler that we are going to use to measure the dimensions.

So now you have to measure the size of the sides of surfaces mentioned before and write the value next to them.

What is the perimeter of each? What is the surface of each?

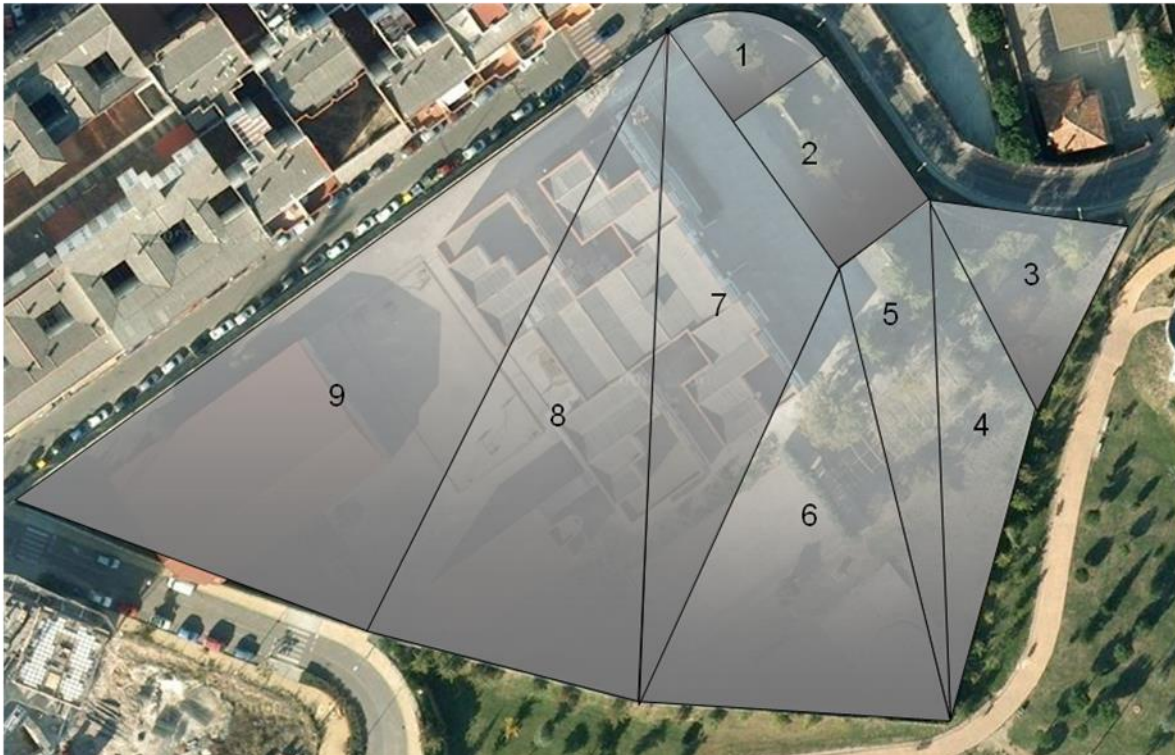
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190

metros





Finally we are going to observe the ground perimeter. The shape is irregular now. You have to mark by drawing a point when the surrounding wall changes its direction. You find segments and arcs.  
How can we get the total area of the school?

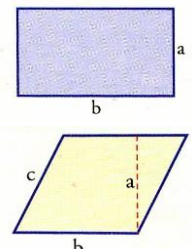
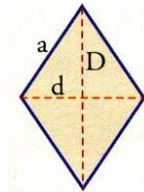
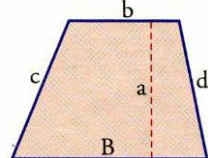
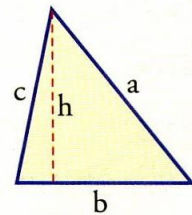
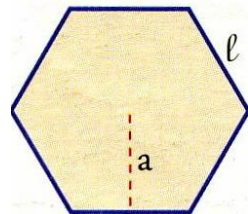


## 1. PERIMETER AND AREA OF POLYGONS

Perimeter is the sum of all the sides of a polygon.

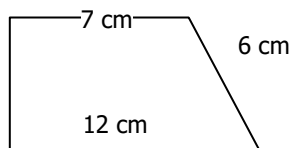
The area is the measure of its surface.

### Quadrilaterals

<p><u>Rectangles and rhomboids</u></p> <p>This is the simplest shape to calculate these measurements.</p> <p>The area is the resulting product of its base by its height.</p>		$A = b \cdot a$
<p><u>Rhombus (rhombuses or rhombi)</u></p> <p>The area is half of the resulting product of its diagonals.</p>		$A = \frac{D \cdot d}{2}$
<p><u>Trapezium (trapeziums or trapezia)</u></p> <p>The area is the result of multiplying half the sum of the bases times the height.</p>		$A = \frac{(B + b)}{2} \cdot a$
<p><u>Triangles</u></p> <p>The area of a triangle is half of the base times the height.</p> <p>The other one is the Heron formula.</p>		$A = \frac{b \cdot h}{2}$ $A = \sqrt{s(s-a)(s-b)(s-c)}$ <p><math>s</math> : semiperimeter</p>
<p><u>Regular polygon</u></p> <p>We deduce its formula from the triangle.</p> <p>The area of a regular polygon is half of the perimeter times the apothem.</p>		$A = \frac{p \cdot a}{2}$

### Example:

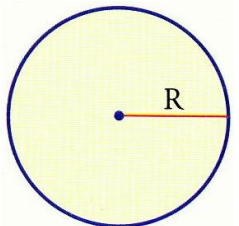
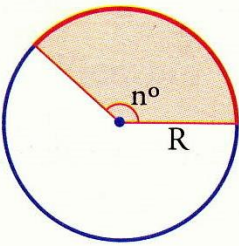
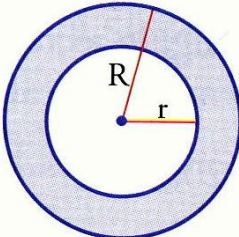
Calculate the height of the next right-angled trapezium whose bases are 7cm and 12 cm and the other side is 6cm. Calculate the area.



## 2. PERIMETER AND AREA OF CIRCUMFERENCE AND CIRCLE

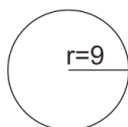
The second kind of shapes you find in nature is the curved lines.

The simplest form among them it is the circumference. You see this shape in the sun, in the moon and it is very easy to make because you only need a radius.

<p><u>Circumference and circle</u></p> <p>The length of a circumference is <math>2 \cdot \pi \cdot R</math>.  The surface area is <math>\pi \cdot R^2</math>.  <math>\pi</math> is close to 3 but it is impossible to get its exact value as a decimal number.  This is the reason why sometimes we use 3.14 and other times 3.1416. It depends on the accuracy you want.</p>		$L = 2\pi r$ $A = \pi r^2$
<p><u>Arches and sectors</u></p> <p>We get the length of an arch or the area of a circular sector through a proportion.</p>		$L = \frac{2\pi R}{360} \cdot n^\circ$ $A = \frac{\pi R^2}{360} \cdot n^\circ = \frac{L \cdot R}{2}$
<p><u>Annulus or circular ring</u></p> <p>The surface of a circular ring we can deduce easily.</p>		$A = \pi R^2 - \pi r^2$

Example:

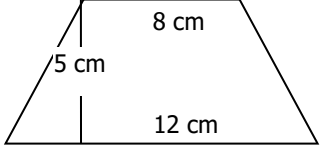
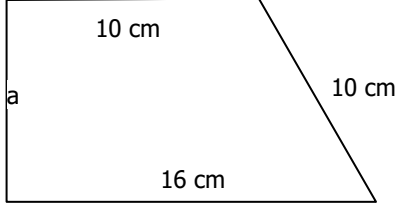
The radius of a circumference is 9 inches, calculate the length and the area.



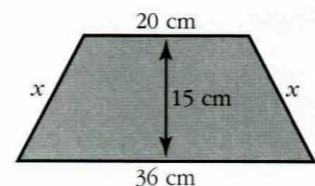
## EXERCISES AND PROBLEMS

### 1. Perimeter and area of polygons

1. A square has a side of 2 cm. Draw the square and find the length of the diagonal and the surface area.
2. Find the area of an equilateral triangle with sides of 24 m.
3. Find the area of an isosceles triangle whose equal sides are 6 m and the base is 10 m.
4. Find the perimeter and the area of a rhombus with two diagonals measuring 8 m and 10 m.
5. The diagonals of a rhombus are  $d = 10\text{ m}$  and  $D = 24\text{ m}$ .  
a) Calculate the perimeter.  
b) Calculate the surface area.
6. The side of a rhombus is 5 m and one of the diagonals is 6 m. Find the area.
7. We know that one diagonal of a rhombus is 80 cm and the length of its sides is 62 cm.  
a. Calculate the length of the other diagonal.  
b. Calculate the area.
8. The diagonals of a rhombus are  $12\frac{1}{4}\text{ cm}$  and  $8\frac{1}{4}\text{ cm}$  respectively. Find the perimeter and the surface area.
9. The side of a rhombus is 10 cm and one of the diagonal is 16 cm. Calculate the other diagonal and the area.
10. Calculate the apothem of a regular hexagon whose radius is 6 cm.
11. Calculate the perimeter and the area of a regular hexagon with a radius of  $6,4\text{ m}$ .
12. Calculate the apothem of a hexagon whose perimeter is 36. Calculate its area.
13. Find the area of a regular hexagon with sides of 6 cm.

<b>14.</b> Find the side of the next isosceles trapezium whose bases are 8cm and 12 cm respectively and the height is 5 cm according to the picture. Find the perimeter and the area.	
<b>15.</b> You see a right-angled trapezium in the figure to the right. Calculate the height by using the data from the picture. Calculate the perimeter and the area.	

16. The bases of an isosceles trapezium measure 23 cm and 58 cm. The two equal sides measure 21 cm.  
a. Draw the trapezium and write down its measures.  
b. Calculate its height.  
c. Calculate the area.
17. Find the lengths of the unknown sides of this isosceles trapezium. Calculate the area
18. In a right-angled trapezium whose bases are 5m and 8m, the not straight side is  $l = 5\text{ m}$ .  
a) Calculate the height.  
b) Find the perimeter.



c) Calculate the area.

- 19.** The side of a regular octagon measures 10 cm and its apothem is 12 cm.  
 a. Draw the octagon and its data.  
 b. Calculate the area.  
 c. Calculate the radius of the polygon.



- 20.** What is the surface area of this stop signal having in mind the figure measurements?
- 21.** The two equal sides of an isosceles triangle measure 50 cm and the height is 38 cm.  
 a. Draw the triangle with its data.  
 b. Find the length of its base –the uneven<sup>1</sup> side-.  
 c. Calculate the area.

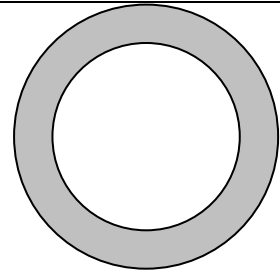
## 2. Perimeter and area of circumference and circle

- 22.** Calculate the length of an arc of circumference whose radius is 5.3 m and its angle is  $63^\circ$  in amplitude.
- 23.** The wheel of a bicycle is 75 cm in diameter. How many turns does it take to go 1 km?
- 24.** Calculate the area of an annulus (ring-shaped object) whose radii are 3.4 cm and 5.2 cm.

<b>25.</b> The square perimeter is 60 cm. Calculate the shaded area.	
<b>26.</b> The radius of the circle is 5m. Find the shaded area.	
<b>27.</b> Calculate the shaded area knowing the square side is 10 m.	
<b>28.</b> Find the area of the next circular segment of a circle of 3 m radius and whose angle is $60^\circ$ .	

<sup>1</sup> Desigual.

- 29.** Calculate the shaded area in the figure, knowing that the radius of the greatest circumference is 9 m and the lowest is 6 m.



- 30.** Calculate the length and the area of the figure to the right.

